

# New Distribution Records for *Sphenomorphus tonkinensis* (Lacertilia: Scincidae) with Notes on Its Variation and Diagnostic Characters

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**Abstract** *Sphenomorphus tonkinensis* is a recently described new species based on specimens collected from northern Vietnam and Hainan, China. Herein, we report 13 additional specimens of *S. tonkinensis* from five new localities in Guangxi, Guangdong and Jiangxi, southern China. These specimens were compared with the type specimens of *S. tonkinensis*, which allows us to revise the diagnostic characteristics of this newly described species. Additional information on morphological variation, distribution and reproductive biology are provided, which extends our understanding of the natural history of *S. tonkinensis*.

**Keywords** *Sphenomorphus tonkinensis*, variation, diagnosis, range extension, southern China

## 1. Introduction

*Sphenomorphus tonkinensis* is a newly described species from northern Vietnam and Hainan, China (Nguyen *et al.*, 2011). During our field surveys from July 2007 to September 2011 in Jiangxi, Guangdong and Guangxi, southern China, we collected an unknown *Sphenomorphus* species that was not assignable to any of the *Sphenomorphus* species currently known in the mainland of southern China, namely, *S. indicus*, *S. incognitus* and *S. maculatus* (Grismer *et al.*, 2009 a, b; Zhao and Adler, 1993; Zhao *et al.*, 1999). We identified these specimens as *S. tonkinensis* based on the combination of the following morphological characters: size small (maximum snout-vent length 52.5 mm); prefrontals in contact with each other (narrowly separated only in one juvenile specimen); supraoculars four; 0–2 pairs of nuchals; lower eyelid moveable, scaly; supralabials seven; primary temporals two; external ear present, without lobules, tympanum slightly sunk; dorsal scales smooth, paravertebral scales 67–76 (65–72 in types of *S. tonkinensis*), not widened; limbs well developed, pentadactyl; scales arranged in

three rows on dorsal surface of base of digit IV; 14–17 smooth lamellae under toe IV (15–19 in types of *S. tonkinensis*); free margins of upper and lower eyelids edged in white; and upper lateral black stripe interrupted by small light colored spots.

These new specimens represent five new localities for the species and the first provincial records from Guangxi, Guangdong and Jiangxi, China. Herein, based on our newly collected specimens, we compared the morphological characters of these specimens with the types, and revised the diagnostic characters of this species accordingly. Further notes on its natural history, reproduction, and distribution are provided.

## 2. Material and Methods

**2.1 Specimens collection** Thirteen individuals were collected from the Wuhuangling Forest Park (22°09'03.6" N, 109°20'19.8" E; 330–420 m a. s. l.) in the Liuwanshan Range, Guangxi; the Heishiding Nature Reserve (23°26'11" N, 111°48'54" E; 190–650 m a. s. l.) in the Yunkaidashan Range and the Shimentai Nature Reserve (24°24'24" N, 113°18'25" E; 200 m a. s. l.), Guangdong; and the Jiulianshan Nature Reserve (24°29'18" N, 114°22'50" E; 510 m a. s. l.), and the Jinggangshan Nature Reserve (26°36'16" N, 114°16'02"

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E; 323 m a.s.l.), Jiangxi, China (Table 1). Permission to visit these sampling sites was issued by the management administration of each reserve or park. This study did not involve endangered or protected species in China. All the specimens were fixed in 10% formalin and transferred to 75% alcohol, and are deposited in the Museum of Biology, Sun Yat-sen University (SYS), Guangzhou, Guangdong, China.

**2.2 Morphological data** Scale terminology follows Grismer *et al.* (2009a, b) and Greer and Shea (2004). Scale counts were taken as follows: mid-body scale rows (MSR, counted as the number of longitudinal scale rows encircling the body at a point midway between the limb insertions); paravertebral scale rows (PSR, counted as the number of scales in a line from the parietal scales to a point on the dorsum opposite the vent); ventral scale rows (VSR, counted as the row of scales between the postmentals and the anal plate); nuchal (NU); supralabials (SPL); infralabials (IFL); and lamellae under toe IV (LT4).

Measurements were taken with vernier calipers to the nearest 0.1 mm, including snout-vent length (SVL, from the tip of the rostral scale to the vent); tail length (TaL, from the tip of the tail to the vent); axilla-groin length (Ax-GnL, from the posterior margin of the forelimb insertion to the anterior margin of the hind limb

insertion); head length (HL, from the anterior margin of the ear opening to the tip of the rostral scale); head width (HW, as the widest portion of the temporal region); and snout to the forelimb length (Sn-FIL, from the anterior margin of the forelimb insertion to the tip of the rostral scale). Sex was determined by dissection. Enlarged gonads were considered evidence of adulthood.

### 3. Results and Discussion

**3.1 Variation of *S. tonkinensis*** Differences between the type specimens and our specimens in measurements and scalation are presented in Table 1 and Table 2. Our 13 new specimens largely resemble the types except that mid-body scale rows are found 35–38 in our specimens (32–34 in type specimens), prefrontals are narrowly separated in one juvenile specimen SYS r000418 (also narrowly separated in one paratype, while in broad contact in other types and our other specimens), and two pairs of nuchals are present in SYS r000543, but absent in other specimens (absent or only one pair present in type specimens). Dorsum of body covered with large dark spots arranged in a line in our adult specimens (SYS r000105, 110, 173, 334, 335, 543 and 606), with many irregular dark spots in juveniles and sub-adults (SYS

**Table 1** Measurement and scalation characters of the 13 new specimens of *S. tonkinensis* in this study.

	SYS r000543	SYS r000105	SYS r000110	SYS r000173	SYS r000606	SYS r000601	SYS r000540	SYS r000541	SYS r000542	SYS r000334	SYS r000335	SYS r000418	SYS r000420
Age	Adult	Adult	Adult	Adult	Adult	Adult	Subadult	Juvenile	Juvenile	Adult	Adult	Juvenile	Juvenile
Sex	♀	♀	♀	♀	♂	♀	/	/	/	♂	♀	/	/
SVL	50.25	41.25	46.28	50.2	49.12	49.96	36.9	29.7	26.2	52.5	45.3	24	25.9
TaL	68.33	/	/	/	/	66.52	56.8	43.7	29.9	71.6	56.1	32.3	/
TaL/SVL	1.36	/	/	/	/	1.33	1.54	1.47	1.14	1.36	1.24	1.35	/
Ax-GnL	28.07	21.67	24.2	28.3	28.25	29.04	19.5	15.7	13.7	28.5	24.2	12.4	13
Sn-FIL	16.64	14.23	15.68	15.78	16.35	16.25	13.5	11.8	10.5	18.2	15.8	8.7	10.3
HL	8.51	7.46	8.3	8.6	8.29	8.43	7	6	5.3	9.1	8.2	5.3	5.5
HW	6.55	4.93	5.33	6.26	5.74	6.06	4.8	4.2	3.6	6.9	6.1	3.6	4
MSR	36	36	36	36	36	35	36	38	36	36	36	36	36
PSR	70	69	73	76	76	73	67	70	69	74	73	73	74
VSR	62	62	62	61	63	65	58	64	62	67	63	64	65
Supraoculars	4	4	4	4	4	4	4	4	4	4	4	4	4
Postsupraoculars	1	1	1	1	1	1	1	1	1	1	1	1	1
Supraciliaries	9, 9	9, 9	9, 9	9, 10	9, 10	9, 9	9, 9	9, 9	10, 11	10, 11	10, 11	10, 11	10, 11
Loreals	2	2	2	2	2	2	2	2	2	2	2	2	2
SPL	7	7	7	7	7	7	7	7	7	7	7	7	7
IFL	7	7	7	7	7	7	7	7	7	7	7	7	7
Primary temporals	2/2	2/2	2/2	2/1	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2
Secondary temporals	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2
LT4	15, 16	16, 16	16, 16	16, 15	15, 15	16, 17	17, 16	14, 14	16, /	15, 16	16, 16	15, 15	16, 16
Locality	W	W	W	H	H	J	W	W	W	G	G	S	S

Note: W: Wuhuangling Forest Park; H: Heishiding Nature Reserve; S: Shimentai Nature Reserve; J: Jiulianshan Nature Reserve; G: Jinggangshan Nature Reserve.

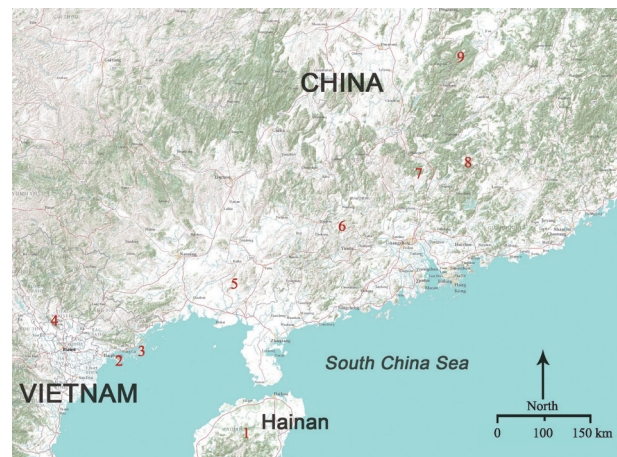
**Table 2** Comparison of the type specimens and newly collected specimens of *S. tonkinensis* from mainland China.

Locality	Type specimens		New specimens in this study		
	Northern Vietnam (n = 8)	Hainan, China (n = 1)	Guangxi, China (n = 6)	Guangdong, China (n = 4)	Jiangxi, China (n = 3)
SVL (maximum, mm)	47.5	48.8	50.3	50.2	52.5
MSR	32–24	34	36–38	36	35–36
PSR	65–72	72	67–73	73–76	73–74
VSR	58–71	60	58–64	61–65	63–67
NU	0–1	0/1	0–2	0	0
Loreals	2	2	2	2	2
Supraciliaries	9	9	9–11	9–10	9
SPL	7	7	7	7	7
IFL	6	7/6	7	7	7
LT4	15–19	19/18	14–17	15–16	15–17
Prefrontals in contact	Yes/no	Yes	Yes	Yes/no	Yes

r000418, 412, 540–542) and one adult (SYS r000601) of our specimens, while dorsum of the body found with a discontinuous dark vertebral stripe in type specimens; flank scattered with light colored dots in our specimens [this character was not mentioned in Nguyen *et al.* (2011)].

**3.2 Revision of diagnostic characters** Due to the variations observed in the additional specimens collected from the mainland of China, the diagnostic characters of *S. tonkinensis* need to be revised accordingly. *S. tonkinensis* differs from other congeners by a combination of the following characters: body size small (maximum SVL 52.5 mm); prefrontals in contact with each other, rarely separated; supraoculars four; nuchals 0–2 pairs; lower eyelid moveable, scaly; supralabials seven; primary temporals two; external ear present, without lobules, tympanum slightly sunk; mid-body scales in 32–38 rows; dorsal scales smooth, paravertebral scales 65–76, not widened; limbs well developed, pentadactyl; scales arranged in three rows on dorsal surface of base of digit IV; 15–19 smooth lamellae present under toe IV; free margins of upper and lower eyelids edged in white; dorsum and tail base bronze brown with a discontinuous dark vertebral stripe or large dark spots arranged in a line; upper lateral body with a black stripe which breaks up into a thicker speckled pattern posterior to shoulder region and interspersed with small light colored spots from behind the neck.

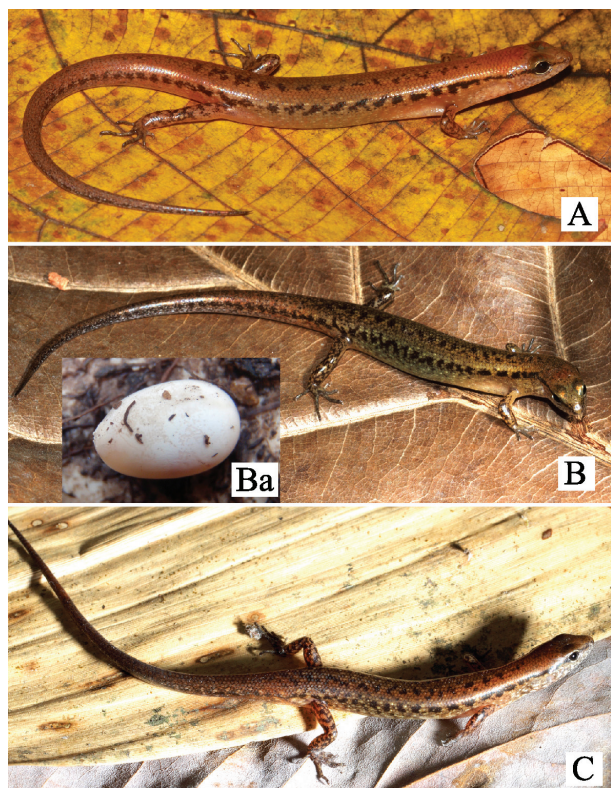
**3.3 Distribution and natural history** Currently, *S. tonkinensis* is known from northern Vietnam, and Hainan, Guangxi, Guangdong and Jiangxi in southern China (Figure 1). All our 13 specimens were recorded and collected in evergreen broad-leaved forests (also called tropical and subtropical mountainous forests) with rich litter and moist soil on forest floor, and they were found in the evening at altitudes ranging between 190 and 650 m a.s.l.



**Figure 1** Map showing the nine known localities of *S. tonkinensis*. 1: Hainan, China; 5: Wuhuangling Forest Park, Guangxi, China; 6: Heishiding Nature Reserve, Guangdong, China; 7: Shimentai Nature Reserve, Guangdong, China; 8: Jiulianshan National Nature Reserve, Jiangxi, China; 9: Jinggangshan National Nature Reserve, Jiangxi, China. 2: Cat Ba Island, Hai Phong, Vietnam; 3: Bai Tu Long, Quang Ninh, Vietnam; 4: Tam Dao Mountain, Vinh Phuc, Vietnam.

One female individual (SYS r000601) collected from the Jiulianshan Nature Reserve, Jiangxi on 24 July 2010 was found with two eggs in its belly, and thus it was raised in our lab for further observation. Subsequently while in captivity, the gravid female laid eggs with leathery shell (5.6 mm × 8.3 mm in size) at night on 31 July (Figure 2 Ba). We dissected one of the eggs and found the egg with an embryo formed. After dissection of the specimen SYS r000543, collected on 26 October 2009 from the Wuhuangling Forest Park, Guangxi, its ovary was found containing twelve immature eggs (the largest 1.2 mm in diameter); that of SYS r000173, collected on 30 May 2009 from the Heishiding Nature Reserve, Guangdong, containing four mature eggs (all 5.4 mm in diameter); that of SYS r000110, collected on 16





**Figure 2** *Sphenomorphus tonkinensis* from mainland China. A: Dorsal view of SYS r000543 (female) from the Wuhuangling Forest Park, Guangxi; B and Ba: Dorsal view of SYS r000601 (female) and its egg from the Jiulianshan National Nature Reserve, Jiangxi; C: Dorsal view of SYS r000334 (male) from the Jinggangshan National Nature Reserve, Jiangxi.

July 2009 from the Wuhuangling Forest Park, Guangxi, containing two mature eggs (5.6 and 4.8 mm in diameter, respectively); and that of SYS r000105, collected on 16 July 2009 from the Wuhuangling Forest Park, Guangxi, containing two mature eggs (5.3 and 5.5 mm in diameter, respectively). Those two smallest individuals (SYS r000418, r000420) were collected in late July, 2011 from the Shimentai Nature Reserve, Guangdong; and the remaining subadult (SYS r000540) and juvenile (SYS

r000541–542) individuals were collected in October, 2009 from the Wuhuangling Forest Park, Guangxi.

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